Abstract

In preparation to the commencement of the LHC considerable effort is devoted to improving the current understanding of QCD radiation. We are concerned here with this issue as manifested in soft gluon bremsstrahlung and non-perturbative effects. We study different observables that are sensitive to soft radiation and deduce the implications for current and future colliders.

We specifically address the possible small-x broadening effects, not accounted for in conventional Q_t resummations, in the Higgs Q_t spectrum at hadronic colliders. As a probe for this we study the DIS Breit current hemisphere Q_t spectrum at HERA. We resum the large logarithms to NLL accuracy, match the result to NLO predictions and smear it with a non-perturbative Gaussian function. Comparing our predictions to HERA data ought to reveal the existence or absence of such small-x effects.

Next we study the impact of jet algorithms on QCD resummation. There are very few resummed predictions for jet-defined quantities, which are often considered in QCD studies relevant (for instance) to the LHC, due to the lack of theoretical insight to all orders in the presence of jet algorithms. We consider the simple case of energy flow into a gap between two jets and compute the dependence of primary emissions on the k_t clustering algorithm. We show how non-global logarithms in this case are even more significantly reduced than suggested before in the literature and estimate the impact of our findings on ZEUS photoproduction data.

We then study the azimuthal correlation distribution for dijet production in DIS at HERA. We perform an NLL resummation and combine the result with NLO predictions. We point to the extension of this work to hadronic collisions at the Tevatron. The results of this analysis are important as this observable is commonly studied by experimentalists, e.g. to extract non-perturbative parameters.

Finally we calculate the power corrections to energy flows in hadronic collisions. This study provides the technology for further analyses of similar observables involving non-trivial colour algebra and dipole geometry.

Chapters 1 to 3 of this thesis are introductory and review chapters while chapters 4 to 7 represent the main results.